National Advisory Committee for Aeronautics

Research Abstracts

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CURRENT NACA REPORTS

NACA Rept. 1174

THE STRUCTURE OF TURBULENCE IN FULLY DEVELOPED PIPE FLOW. John Laufer, National Bureau of Standards. 1954. ii, 18p. diagrs. (NACA Rept. 1174. Formerly TN 2954)

Measurements, principally with a hot-wire anemometer, were made in fully developed turbulent flow in a 10-inch pipe at speeds of 10 and 100 feet per second. It is shown that rates of turbulent-energy production, dissipation, and diffusion have sharp maximums near the edge of the laminar sublayer and that there exist a strong movement of kinetic energy away from this point and an equally strong movement of pressure energy toward it. It is suggested that the flow field may be divided into three regions: Wall proximity where turbulence production, transfer, and viscous action are of about equal importance; the central region of the pipe where energy diffusion predominates; and the intermediate region where the local rate of change of turbulent-energy production dominates the energy received by diffusive action.

NACA Rept. 1181

STRUCTURAL RESPONSE TO DISCRETE AND CONTINUOUS GUSTS OF AN AIRPLANE HAVING WING-BENDING FLEXIBILITY AND A CORRELATION OF CALCULATED AND FLIGHT RESULTS. John C. Houbolt and Eldon E. Kordes. 1954. ii, 22p. diagrs., 4 tabs. (NACA Rept. 1181. Formerly TN 3006)

An analysis is made of the structural response to gusts of an airplane having the degrees of freedom of vertical motion and wing bending flexibility. Convenient solutions of the response equations are developed for discrete and sinusoidal-gust encounter, and the procedure is given for treating the realistic condition of continuous random atmospheric turbulence. Flight and calculated results are then given for several airplanes to evaluate the influence of wing bending flexibility on the structural response to gusts. The discrete-gust approach is shown to reveal the general nature of the flexibility effects and leads to qualitative correlation with flight results. The continuous-turbulence approach shows good quantitative correlation and indicates a much greater degree of resolution of flexibility effects.

NACA Rept. 1193

THEORETICAL PERFORMANCE CHARACTERISTICS OF SHARP-LIP INLETS AT SUBSONIC SPEEDS. Evan A. Fradenburgh and DeMarquis D. Wyatt. 1954. ii, 8p. diagrs. (NACA Rept. 1193. Formerly TN 3004)

A method is presented for the estimation of the subsonic-flight-speed characteristics of sharp-lip inlets applicable to supersonic aircraft. The analysis, based on a simple momentum balance consideration, permits the computation of inlet pressure recovery - mass-flow relations and additive-drag coefficients for forward velocities from zero to the speed of sound. Operation of a sharp-lip inlet at velocity ratios less than 1.0 results in an additive drag that is not cancelled by lip suction, while at velocity ratios greater than 1.0, losses in inlet total pressures result. In particular, at the take-off condition, the total pressure and the mass flow for a choked inlet are only 79 percent of the values ideally attainable with a rounded lip.

NACA RM 54L29

METEOROLOGICAL PROBLEMS ASSOCIATED WITH COMMERCIAL TUBOJET-AIRCRAFT OPERATION. A working group of the NACA Subcommittee on Meteorological Problems. June 1955. 46p. (NACA RM 54L29)

Meteorological requirements and problems anticipated with the safe, efficient, and economical operation of commercial turbojet aircraft have been analyzed and evaluated. Problems of temperature, wind, pressure, ceiling, visibility, cloud and clear-air turbulence, icing, and communication are discussed. Characteristics such as high cruising speed, high cruise level, relatively high fuel consumption, and engine performance sensitive to temperature and air density are considered.

NACA RM E55D07b

EXPLORATORY INVESTIGATION OF FLOW IN THE SEPARATED REGION AHEAD OF TWO BLUNT BODIES AT MACH NUMBER 2. Harry Bernstein and William E. Brunk. June 1955. 27p. diagrs., photos. (NACA RM E55D07b)

Flow separation from a flat plate ahead of two blunt two-dimensional bodies was investigated at Mach number 2.0. Interferograms were obtained for the regions, and the pitot-pressure distribution and flow directions were surveyed in one of the regions. Mach numbers were generally less than 0.5 in the reverse-flow regions near the plate surface. A flow-direction survey for a model with separation at the leading edge of the flat plate showed a reverse-flow component in about half of the separated region.

NACA RM L55D21

VELOCITY DISTRIBUTIONS MEASURED IN THE SLIPSTREAM OF EIGHT-BLADE AND SIX-BLADE DUAL-ROTATING PROPELLERS AT ZERO ADVANCE. Leland B. Salters, Jr. June 1955. 27p. diagrs., photo. (NACA RM L55D21)

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This report contains the results of a slipstream survey behind NACA 8.75-(5)(05)-037 eight- and six-blade dual-rotating propellers at zero advance. The slipstream-boundary cone angle was found to agree qualitatively with the theoretical angle of spread for an unheated jet.

NACA RM L55E10b

EXPERIMENTAL ANALYSIS OF MULTICELL WINGS BY MEANS OF PLASTIC MODELS. George W. Zender. June 1955. 6p. diagrs. (NACA RM L55E10b)

The stresses and deflections of a plastic model of a delta multicell wing are compared with results obtained by the use of the Cal-Tech analog computer. The comparison indicates that valuable information may be obtained for experimental structural analyses from tests of plastic models.

NACA RM L55E12c

VERTICAL AND DRAG GROUND-REACTION FORCES DEVELOPED IN LANDING IMPACTS OF A LARGE AIRPLANE. Richard H. Sawyer, Albert W. Hall and James M. McKay. June 1955. 12p. diagrs. (NACA RM L55E12c)

Tests were conducted on a large-bomber-type airplane to determine the ground reactions imposed on the landing gear under actual landing conditions. The program covered landings made at vertical velocities up to 8.5 feet per second and forward speeds at contact from 95 to 120 miles per hour. Landings were made on both wet and dry concrete runways. Results are presented of the effects of vertical velocity at contact and the effects of runway surface condition (wet and dry) on the vertical and drag ground reactions obtained during the landing impact.

NACA TM 1391

REDUCTION OF THE SHIMMY TENDENCY OF TAIL AND NOSE-WHEEL LANDING GEARS BY INSTALLATION OF SPECIALLY DESIGNED TIRES. (Verminderung der Flatterneigung von Sporn- und Bugwerken durch Einbau besonders geformter Reifen). H. Schrode. July 1955. 13p. diagrs. (NACA TM 1391. Trans. from Deutschen Versuchsanstalt für Luftfahrt E. V., Berlin-Adlershof. Technische Berichte, v. 10, 1943, p. 113-116)

An experimental study is made of the shimmy tendency of several conventional and modified German aircraft tires ranging in size from about 11 to 15 inches in diameter. The effects of tire size, shape, loading and wear, type of rolling motion (acceleration or deceleration), trail and rolling velocity on the shimmy tendency are investigated. It is found that tires of small main dimensions with stiff flattened running surfaces, high lateral and torsional stiffnesses and small ground contact areas are favorable for reduction of the shimmy tendency.

NACA TN 3299

MAXIMUM THEOREMS AND REFLECTIONS OF SIMPLE WAVES. P. Germain, Brown University. June 1955. 22p. (NACA TN 3299)

The properties of the solutions corresponding to the reflection of a centered simple wave along a straight line or along a free streamline are shown to be closely related to some important theorems predicting "a priori bounds" for special mathematical problems. These properties thus appear to be a physical interpretation of those theorems.

NACA TN 3421

AERODYNAMICS OF A RECTANGULAR WING OF INFINITE ASPECT RATIO AT HIGH ANGLES OF ATTACK AND SUPERSONIC SPEEDS. John C. Martin and Frank S. Malvestuto, Jr. July 1955. 114p. diagrs., tab. (NACA TN 3421)

Perturbation of the flow over a two-dimensional flat plate at finite angles of attack is used to obtain a first-order evaluation of damping in roll, lift and moment due to an increment in angle of attack, and lift and moment due to steady pitching velocity for a rectangular wing of infinite aspect ratio at supersonic speeds. Results are valid for the range of Mach number and angle of attack for which the flow behind the shock is supersonic. The analysis is based on the equations for rotational flow so that the change in entropy is taken into account. Approximate estimates of a number of aerodynamic derivatives of rectangular wings at finite angles of attack are also presented.

NACA TN 3443

SHEARING EFFECTIVENESS OF INTEGRAL STIFFENING. Robert F. Crawford and Charles Libove. June 1955. 37p. diagrs., photo., tab. (NACA TN 3443)

Values of coefficients for defining the effectiveness of integral stiffeners in resisting shear deformations of the plate of which they are an integral part are presented for a variety of proportions of rectangular stiffeners with circular fillets. Formulas are given in which these coefficients may be employed to calculate the elastic constants associated with the twisting and shearing of integrally stiffened plates. The size of fillet radius is shown to contribute appreciably to the degree of penetration of the stresses from the skin into the stiffener.

NACA TN 3455

RECOVERY AND TIME-RESPONSE CHARACTERISTICS OF SIX THERMOCOUPLE PROBES IN SUBSONIC AND SUPERSONIC FLOW. Truman M. Stickney. July 1955. 25p. diagrs., photos., 2 tabs. (NACA TN 3455)

Experimental data obtained from three shielded and three unshielded thermocouple probes are presented. Data taken in air at room temperature over the ranges 0.2 to 2.2 Mach number and 0.2 to 2.2 atmospheres total pressure show reproducible systematic variations of recovery with Mach number, ambient pressure, flow angle, and probe design. Time-constant data determined at Mach 0.2 and room temperature and pressure indicate that unshielded probes are several times faster in response to temperature changes than shielded probes.

NACA TN 3456

PROPAGATION OF A FREE FLAME IN A TURBULENT GAS STREAM. William R. Mickelsen and Norman E. Ernstein. July 1955. 89p. diagrs., photos., 2 tabs. (NACA TN 3456)

Effective turbulent free-flame speeds measured in turbulent, flowing propane-air mixtures were found to have statistical distributions about mean values. The statistical spread was greater for rich and lean fuel-air ratios and at high turbulence intensities. The measured flame speeds, together with hot-wire-anemometer measurements, formed a basis for comparison with three theories and other types of flames. Although the free-flame speeds are lower than those for turbulent Bunsen and stabilized flames, values calculated from the Tucker analysis and a modified Scurlock-Grover analysis seem to form an upper limit to the turbulent free-flame-speed data.

NACA TN 3458

UNSTABLE CONVECTION IN VERTICAL CHANNELS WITH HEATING FROM BELOW, INCLUDING EFFECTS OF HEAT SOURCES AND FRICTIONAL HEATING. Simon Ostrach. July 1955. 38p. diagrs., 3 tabs. (NACA TN 3458)

Solutions are found for the cases in which the wall temperature variations are linear and (1) the wall temperatures are specified, (2) the walls are both insulated, and (3) the net mass flow in the channel is zero. The heat sources affect the flows in essentially a quantitative manner, changing the stability characteristics of the flows only when both walls are insulated. The effects of frictional heating are important in certain ranges of the parametric values, especially near critical Rayleigh numbers.

NACA TN 3459

SIMPLIFIED PROCEDURES AND CHARTS FOR THE RAPID ESTIMATION OF BENDING FREQUENCIES OF ROTATING BEAMS. Robert T. Yntema. June 1955. ii, 90p. diagrs., 6 tabs. (NACA TN 3459. Supersedes and extends RM L54G02)

A Rayleigh energy approach utilizing the nonrotating-beam bending modes in the determination of the bending frequencies of the rotating beam is evaluated and is found to give good practical results for helicopter blades. Charts are presented for the rapid estimation of the first three bending frequencies for rotating and nonrotating cantilever and hinged beams. A more exact mode-expansion method used in evaluating the Rayleigh approach is also described. Numerous mode shapes and derivatives are presented in tabular form and discussed.

NACA TN 3500

CORRECTION OF ADDITIONAL SPAN LOADINGS COMPUTED BY THE WEISSINGER SEVEN-POINT METHOD FOR MODERATELY TAPERED WINGS OF HIGH ASPECT RATIO. John DeYoung and Walter H. Barling, Jr. July 1955. 31p. diagrs. (NACA TN 3500)

A simple procedure is found which results in more accurate span loadings, lift-curve slopes, and spanwise centers of pressure being read directly from the charts of NACA Report 921. The new results compare very well with experiment and with theoretical results believed to be accurate.

NACA TN 3501

THE TRANSONIC CHARACTERISTICS OF 22 RECTANGULAR, SYMMETRICAL WING MODELS OF VARYING ASPECT RATIO AND THICKNESS. Warren H. Nelson and John B. McDevitt. June 1955. 109p. diagrs., photos. (NACA TN 3501. Formerly RM A51A12)

An investigation utilizing the transonic-bump technique was made to determine the aerodynamic characteristics at transonic Mach numbers of 22 rectangular wings having aspect ratios of 6, 4, 3, 2, 1.5, 1, and 0.5, and NACA 63A0XX sections with thickness-to-chord ratios of 10, 8, 6, 4, and 2 percent. The Mach number range was 0.4 to 1.1, corresponding under the test conditions to a Reynolds number range from 1.25 to 2.05 million. These data are presented without analysis.

NACA TN 3504

EFFECT OF TRAILING-EDGE THICKNESS ON LIFT AT SUPERSONIC VELOCITIES. Dean R. Chapman and Robert H. Kester. June 1955. 19p. diagrs. (NACA TN 3504. Formerly RM A52D17)

Lift forces on various rectangular-plan-form wings were measured in the Mach number range between 1.5 and 3.1 at Reynolds numbers between 0.55 and 2.2 million. The wings differed in trailing-edge thickness, profile shape, maximum thickness ratio, and aspect ratio. Measurements were made on wings with and without a boundary-layer trip and are compared to theoretical calculations. Calculated results using shock-expansion theory are presented for Mach numbers up to 10. In general, thickening the trailing edge resulted in an increase in lift-curve slope. This increase varied between a few percent and about 15 percent, depending primarily on the trailing-edge thickness. Calculations indicate that somewhat greater increases are possible at high supersonic Mach numbers.

NACA TN 3508

LAMINAR FREE CONVECTION ON A VERTICAL PLATE WITH PRESCRIBED NONUNIFORM WALL HEAT FLUX OR PRESCRIBED NONUNIFORM WALL TEMPERATURE. E. M. Sparrow. July 1955. 34p. diagrs. (NACA TN 3508)

An analysis is made for laminar free convection on a vertical plate with prescribed nonuniform thermal conditions at the surface. For the situation where the wall-heat-flux variation is prescribed, graphs are presented from which the resulting variation of the wall temperature and local heat-transfer coefficient can be found. Results for the important special case of uniform wall heat flux are given. For the situation where the wall-temperature variation is prescribed, graphs are given for the over-all heat-transfer rate and local heat-transfer coefficient. All results are given for Prandtl numbers from 0.01 to 1000. Boundary-layer theory is used in conjunction with the Kármán-Pohlhausen method.

NACA TN 3513

HEAT TRANSFER AT THE FORWARD STAGNATION POINT OF BLUNT BODIES. Eli Reshotko and Clarence B. Cohen. July 1955. 17p. diagrs. (NACA TN 3513)

Relations are presented for the calculation of heat transfer at the forward stagnation point of both two-dimensional and axially symmetric blunt bodies. The relations for the heat transfer, which were obtained from exact solutions to the equations of the laminar boundary layer, are presented in terms of the local velocity gradient at the stagnation point. These exact solutions include effects of variation of fluid properties, Prandtl number, and transpiration cooling. Examples illustrating the calculation procedure are presented.

NACA TN 3517

APPROXIMATE METHOD FOR DETERMINING EQUILIBRIUM OPERATION OF COMPRESSOR COMPONENT OF TURBOJET ENGINE. Merle C. Huppert. July 1955. 25p. diagrs. (NACA TN 3517)

A method is presented for estimating the equilibrium operating line for a compressor as a component part of a turbojet engine. The results of this analysis are presented in chart form to facilitate rapid determination of the equilibrium operating line. Predicted and measured equilibrium operating conditions are compared in terms of compressor pressure ratio and equivalent weight flow; satisfactory agreement is indicated.

BRITISH REPORTS

N-38032*

Royal Aircraft Establishment (Gt. Brit.)
A REVISED ESTIMATE OF A RELATIONSHIP BETWEEN BEARING STRENGTH AND HARDNESS FOR METALLIC STRUCTURAL MATERIALS. R. F. Mousley. January 1955. 9p. diagr., 4 tabs. (RAE Tech. Note Structures 144)

A revised estimate is made of a relationship between bearing strength and hardness for metaltic structural materials.

N-38033*

Royal Aircraft Establishment (Gt. Brit.)
THE EFFECT OF NUMBER OF RIGGING LINES ON THE STRENGTH OF AN EXETER TYPE 12 PARACHUTE CANOPY. J. Picken. January 1955. 11p. diagrs., photos., 2 tabs. (RAE Tech. Note Mech. Eng. 197)

The number of rigging lines has been shown to have an effect on the strength of an Exeter-type 12 parachute canopy. In a series of flight tests it was demonstrated that a canopy rigged with eight lines is not so strong as one rigged with 16 lines. Amendments to the appropriate design formula are suggested.

N-38034*

Royal Aircraft Establishment (Gt. Brit.)
THE ELECTRICAL RESISTIVITY OF SODIUM BETWEEN 78° K AND 372° K. F. J. Bradshaw and S. Pearson. February 1955. 14p. diagrs. (RAE Met. 84)

The electrical resistivity of sodium has been measured from 78° K to slightly beyond the melting point. The specimens used consisted of distilled sodium in fine thin-walled nickel tubes. The results are compared with previously published figures. There is a small rise in the R/T v. T curve in the region 300° K to the melting point, which is not simply accountable for by present conductivity theories, and the hypothesis that part of the high temperature resistance is due to the presence of lattice defects is considered. Measurements on solid sodium were made to within 0.04° of the melting point and the resistance increased uniformly to this temperature. Some attempts were made to measure excess resistivity due to defects retained after quenching the solid from temperatures near the melting point, or after mechanical deformation at 63° K, but these were unsuccessful.

N-38035*

Royal Aircraft Establishment (Gt. Brit.)
TITANIUM-VANADIUM ALLOYS. G. I. Lewis, K. S. Jepson and H. Brooks. February 1955. 40p. diagrs., photos., 12 tabs. (RAE Tech. Note Met. 208)

Titanium-base alloys containing 5- to 30-percent vanadium were prepared as 0.07-in. thick rolled strip and tested in various conditions to determine the best tensile properties obtainable from them by heat treatment. An alloy with 16-percent vanadium showed most promise as a structural sheet material. After quenching from 800° C it had a tensile strength of 51 tons/sq in. with 29-percent total and 26-percent uniform elongation, and a minimum bend radius of IT. By overaging at 400 to 475° C, this soft condition could be converted to various hard conditions with strengths ranging from 71 tons/sq in. with 12-1/2 percent elongation to 88 tons/sq in. with 5-percent elongation. When aged to a 20° C strength of 81 tons/sq in., the tensile and shear moduli were 14.3 and 5.4 x 10^6 lb/sq in., respectively; the strength at 350° C was 65 tons/sq in. and after 1000 hours exposure at this temperature, the 20° C properties were substantially unchanged. The density of the alloy was 4.74 gm/cc or 0.17 lb/cu in. A number of ternary alloys based on the Ti-16-percent V composition were also examined.

N-38041*

Royal Aircraft Establishment (Gt. Brit.)
A CONSTRUCTIONAL METHOD FOR MINIMISING THE HAZARD OF CATASTROPHIC FAILURE IN A PRESSURE-CABIN. D. Williams. March 1955. 7p. (RAE Tech. Note Structures 156)

A method is put forward for substantially reducing the chances of a local failure in the shell of a pressure cabin from developing into catastropic failure of the cabin. The increased safety is achieved without weight penalty, and consists essentially in using closely spaced (10 inches or thereabouts) transverse flat bands, the material for which is obtained by reducing the sheet thickness normally available for the shell walls.

N-38042*

Nat. Gas Turbine Establishment (Gt. Brit.)
SOME EFFECTS OF SCALE AND MATERIAL ON THE BURSTING SPEEDS OF TURBINE DISCS. A. Graham, T. M. Jones and V. C. H. Bailey. January 1955. 12p. diagrs., 5 tabs. (NGTE R.166)

The measured bursting speeds of turbine disks of related profiles and several diameters in several materials are compared. Within the experimental range, the desirable amount of reinforcement about a central bore is found to vary with material and scale, but a moderate amount of reinforcement will offset the weakness due to a bore. Larger disks in various materials appear to behave like smaller disks in a brittle material. It is concluded that model experiments offer a better basis for comparison of disk profiles than elastic calculations.

N-38043*

Royal Aircraft Establishment (Gt. Brit.)
LUBRICATION: THE RATE OF SPREADING AND CREEP OF OILS AND OTHER LIQUIDS OVER SOLID SURFACES. E. B. Bielak, G. F. N. Calderwood and E. J. W. Mardles. March 1955. 21p. diagrs., 3 tabs. (RAE Tech. Note Chem. 1245)

The rate of radial spreading of liquid pools over and between horizontal surfaces and of the spontaneous movement of liquid columns into horizontal capillaries has been measured for a variety of liquids under different conditions of test. A resistance to flow, due to thin films extending from the liquid periphery, and which is variable with time of resting, rate of movement, etc., has been recorded. The slow movement which is non-Newtonian and affected by a number of specific factors other than the physical ones of viscosity, density, etc. can be correlated with results for several liquid properties, that is, friction, adhesion, and the dispersive power of the liquids for finely divided solids. The contact angle and hysteresis of contact angles hypotheses are inadequate for explaining the results obtained. The significance of the results in relation to lubrication theory is discussed briefly.

N-38044*

Royal Aircraft Establishment (Gt. Brit.)
LOADING CONDITIONS FOLLOWING AN AUTOMATIC PILOT FAILURE (RUDDER CHANNEL). D. R. Puttock. February 1955. 35p. diagrs., tab. (RAE Tech. Note Structures 154)

A method is presented for the determination of the critical loading conditions of aircraft that ensue from an automatic pilot failure in the rudder channel. General expressions have been derived through response theory for the angle of sideslip, fin-and-rudder load, and lateral acceleration both at the c. g. of the aircraft and at the tail, that result from the sequence of rudder movements assumed to follow an automatic pilot failure. Analysis of these general expressions leads to formulas suitable for assessing the numercial values of the critical loading conditions and it is suggested that these formulas might form a basis for the interpretation of the appropriate design requirement. An example is given to illustrate the type of response produced by a rudder channel failure and the calculation procedure.

N-38045*

Royal Aircraft Establishment (Gt. Brit.)
LOADING CONDITIONS FOLLOWING AN AUTOMATIC PILOT FAILURE (ELEVATOR CHANNEL). D. R. Puttock. February 1955. 50p. diagrs., tab. (RAE Tech. Note Structures 153)

A proposal is made for a standard procedure for calculating the critical loading conditions ensuing from an automatic pilot failure in the elevator channel. General expressions are derived through respone theory for the increments in normal acceleration at the c. g. of the aircraft, normal acceleration at the tail, and aerodynamic load on the tailplane which result from the sequence of elevator movements assumed to follow a failure. Analysis of these general expressions leads to formulas suitable for assessing the numerical values of the critical loads on the wing and tailplane. The influence of the sequence of elevator movements on the loading conditions is discussed with reference to an example.

MISCELLANEOUS

N-37238*

INTERPRETATION OF WIND-TUNNEL DATA IN TERMS OF DYNAMIC BEHAVIOR OF AIRCRAFT AT HIGH ANGLES OF ATTACK. Ralph W. Stone, Jr. (Presented to Wind Tunnel and Model Testing Panel of Advisory Group for Aeronautical Research and Development, Ottawa, Canada, June 10-14, 1955) 32p. diagrs.

With the advent of jet-propelled aircraft and flight near and beyond the speed of sound, the basic airplane configuration has changed markedly. Most noticeable and important in this change has been the trend to low-aspect-ratio wings, swept-wing plan forms, and the general concentration of weight along the fuselage. The aerodynamic characteristics which basically result from the major changes in airplane configurations and which tend to cause inadvertent excursions of airplanes to large angles of attack and sideslip are nonlinear static pitching-moment characteristics at moderately low-lift coefficients, losses in directional stability, dihedral effectiveness, and roll damping at angles below the stall; and loss of directional stability with increasing Mach number in the supersonic range. The effect of inertia coupling is also of major influence. These characteristics which can cause inadvertent and uncontrolled motions and their recognition from wind-tunnel measure-moments are discussed.

N-37434*

AEROELASTIC EFFECTS OF AERODYNAMIC HEATING. Hugh L. Dryden and John E. Duberg. (Presented to Fifth General Assembly of Advisory Group for Aeronautical Research and Development, Ottawa, Canada, June 10-17, 1955) 18p. diagrs.

The design of aircraft to withstand aeroelastic difficulties at high supersonic speeds will of necessity require the consideration of the effects of aerodynamic heating. Among the various aeroelastic consequences of aerodynamic heating, the reduction of over-all stiffness through the action of thermal

stress is the most novel and may well turn out to be the most serious. An appreciation of this phenomenon must become part of the working equipment of the modern aeroelastician.

N-37552*

THE SIMULATION AND MEASUREMENT OF AERODYNAMIC HEATING AT SUPERSONIC AND HYPERSONIC MACH NUMBERS. Jackson R. Stalder and Alvin Seiff. (Presented to Wind Tunnel and Model Testing Panel of Advisory Group for Aeronautical Research and Development, Ottawa, Canada, June 10-14, 1955) 25p. diagrs., photos.

The purpose of this paper is to review the experience of the Ames Laboratory of the NACA with respect to the simulation and measurement of aerodynamic heat transfer at supersonic and hypersonic speeds.

UNPUBLISHED PAPERS

N-37541*

GYROPLANES (HELICOPTERS) WITH ROTORS THERMOPROPELLED BY LOW-PRESSURE FLUID. (Giravions á rotors thermopropulsés par fluide moteur à basse pression). M. René Dorand. June 1955. 52p. diagrs., photo., tabs. (Trans. from Technique et Science Aéronautiques, no. 3, 1951, p. 158-189)

The propelling fluid has a compression ratio of from 1.15 to 1.4; temperature of the order of 130° C; and velocity of from 200 m/sec to 300 m/sec. It is produced by a generator placed in the fuselage and distributed by means of a rotating joint in the longerons of the rotor and escapes by means of streamline propulsion nozzles in the blade profile whose orifices are distributed over span and depth of the blade. Part of the propelling fluid is used for directional maneuvering, and in certain cases, for direct propulsion of the machine. Expensive power transmission machinery is eliminated and fuel economy results.

N-37596*

ESTIMATION OF ERRORS IN THE APPROXIMATE SOLUTION OF LINEAR PROBLEMS. (Otsenki pogreshnostei priblizhennykh reshenii lineinykh zadach). M. G. Slobodyanskii. 23p. (Trans. from Prikladnaya Matematika i Mekhanika, v. 17, no. 2, Mar.-Apr., 1953, p. 229-244)

The present paper is devoted to the further development of the method of constructing the approximate solution and estimation of the error in linear problems reducible to variational problems. The results are applied to the boundary problem for the ordinary differential equation, and certain numerical examples are considered.

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